WRIGHT ENGINEERING
175 S. San Antonio Road
Los Altos, California 94022
(415) 941-4405

Type 32 Precision IF Attenuators

Alltech

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729

AIL Type 32

Precision IF Attenuators

FEATURES

WIDE RANGE

Attenuation continuously variable from 0 to over 100 dB above a minimum insertion loss of about 18 dB.

HIGH ACCURACY

Incremental attenuation between dial settings accurate within 0.005 dB/10 dB + 0.03 dB. An additional nonlinearity does not exceed 0.03 dB when using 0.00 as the reference reading and is negligible when using a reference reading of 10.00 dB or greater.

SENSITIVE INDICATOR

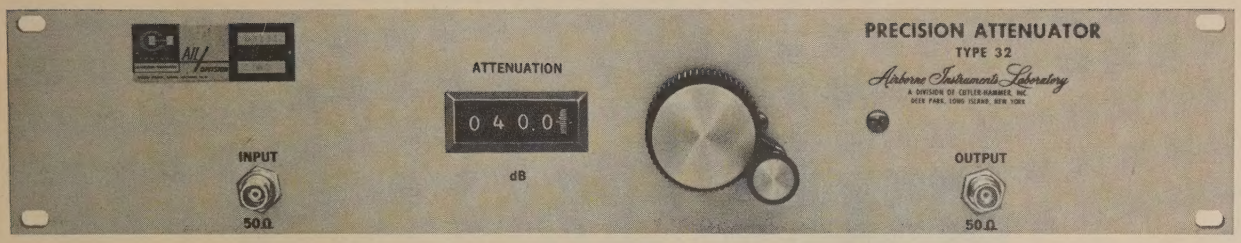
Digital counter dial permits readings to 0.01 dB directly (smallest division) and interpolation to 0.005 dB.

STABLE

Rugged construction ensures trouble-free operation and stability of calibration.

CHOICE OF MODELS

Two standard 50-ohm models are available: Model 03230 for operation at 30 MHz and Model 03260 for operation at 60 MHz. Maximum input power for each is 1 watt. On special order, units can be supplied for use at other center frequencies and with other input and output impedances.



TYPE 32 FOR 19-INCH RACK MOUNTING

APPLICABILITY

The AIL Type 32 Precision Attenuator consists of a cylindrical cavity whose diameter is such that it forms a waveguide well below cutoff at its operating frequency. The launch coil is part of a piston that travels in an axial direction in the waveguide. This coil is tuned by a series capacitor, and the tuning elements are loaded with a series resistor to provide the proper input impedance.

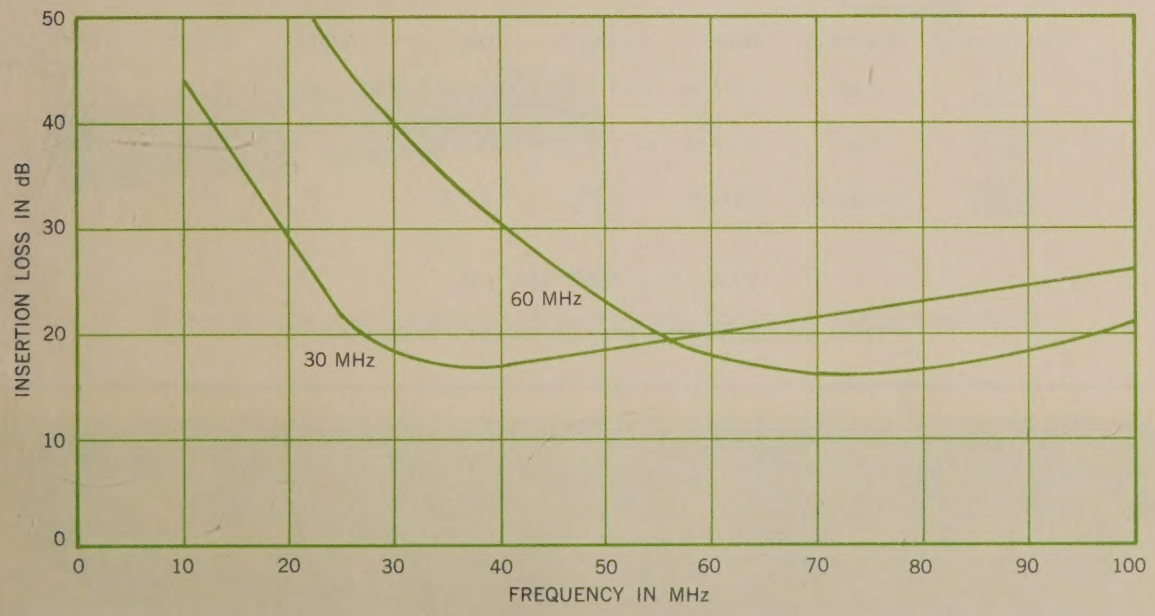
The receiving coil is fixed at the opposite end of the waveguide. This coil is also tuned with a series capacitor and loaded with a series resistor, thus providing the 50-ohm output impedance.

True wave propagation does not exist in a waveguide below cutoff. The fields are exponentially attenuated down the length of the waveguide with a rate of attenuation that is determined by the transmission mode. For any single mode, the attenuation (in dB) is a linear function of the length of the waveguide. The effective length of the waveguide can be changed by varying the separation between the coils. Thus, for a practical mode, the attenuation (in dB) can be read directly from the linear counter dials.

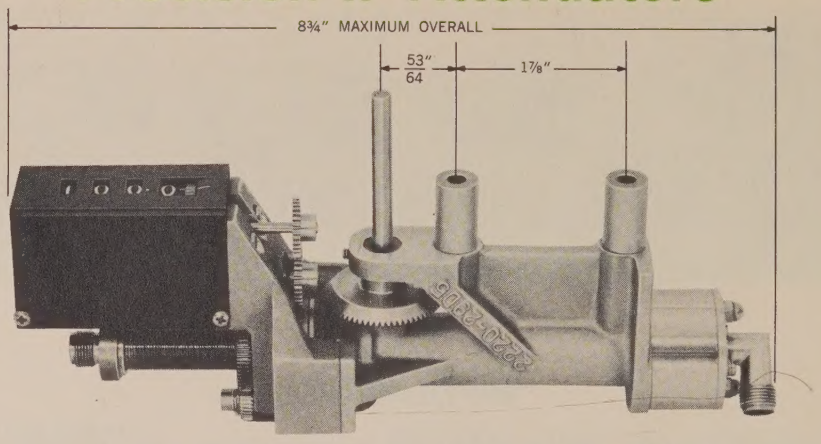
The primary transmission mode of this precision attenuator is a TE_{11} mode. This mode has the lowest attenuation constant. Other modes which may be generated have a higher attenuation rate than this primary mode of transmission. If the separation between the two coils were reduced to where coupling to the spurious modes is significant, the linearity of the attenuation (in dB) versus distance characteristic of the attenuator would be affected. Consequently, in a practical device of this sort, it is necessary to provide a minimum separation between the radiating and receiving coils and, thus, preserve the accuracy of the attenuator. This separation naturally introduces a fixed attenuation between the input and output of the precision attenuator, which is called the minimum insertion loss of the device. Careful design of the radiating and receiving coils and selection of an optimum waveguide diameter allow such close coupling that this precision attenuator exhibits a minimum insertion loss of 18 dB. Specially designed matched units are available for center frequencies as low as 10 MHz and as high as 100 MHz.

The plot of frequency versus minimum insertion loss applies for the case of operation between a 50-ohm source and a 50-ohm load (both resistive). If these conditions are changed, reflections will occur, changing the plotted values.

The incremental attenuation between counter settings will be accurate in all cases; only the minimum insertion loss will change because of the considerations stated above.



AIL Type 32
Precision IF Attenuators



TYPE 32 UNMOUNTED VERSION

The AIL Type 32 Attenuators are available in three versions.

CASE-MOUNTED

Designed for bench use; housed in a walnut case having a brushed aluminum panel.

RACK-MOUNTED

Designed for easy installation on a standard 19-inch relay rack; has brushed aluminum finish.

UNMOUNTED

Designed for easy installation according to customer's requirements.

Part Number	Mounting	Weight	Length	Depth	Height	Price*
03232 03262	Case	3-1/4 lb	14-1/4"	4-1/2"	4-1/2"	$525
03231 03261	Rack	3-1/4 lb	19"	3-1/4"	3-15/32"	$500
03230 03260	Unmounted	1-3/4 lb	max. 8-3/4"	3-1/8"	2-1/8"	$475

*F.O.B. DEER PARK, NEW YORK

Prices and specifications subject to change without notice.

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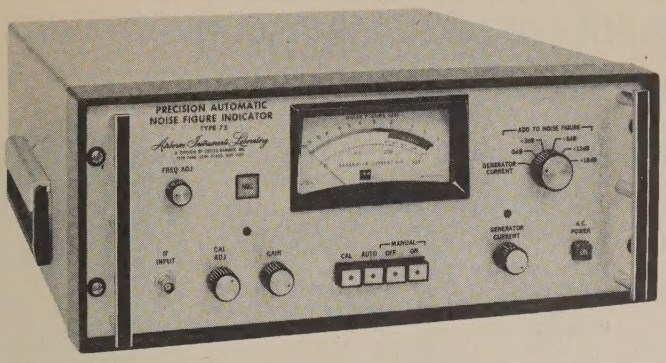
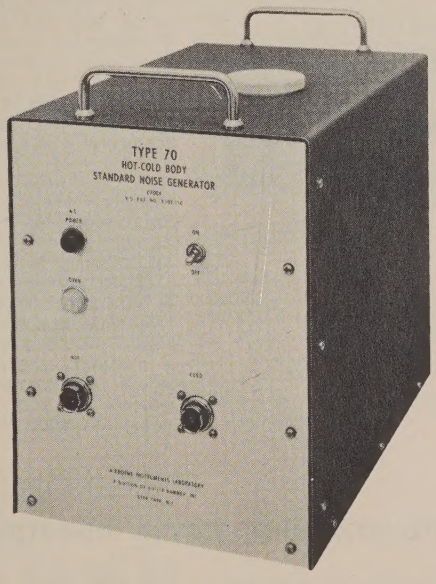
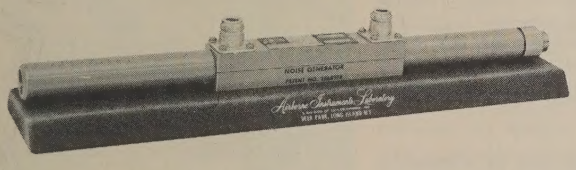
Noise Figure Instruments







A complete line of instruments for laboratory, production line, or standards laboratory

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729

Automatic Noise Measurement...

...only AIL instruments provide the accuracies you require.... for Noise-Figure Measurement below 6 dB

TYPE 75 PRECISION AUTOMATIC NOISE FIGURE INDICATOR

The AIL Type 75 Precision Automatic Noise Figure Indicator is the latest development in the field of automatic noise figure measurement. Presently achievable noise figures of 5 dB, 3 dB, and lower can be measured automatically to accuracies of ±0.15 dB.

The Type 75 features an internal calibrator which permits automatic compensation for noise generator excess noise ratios from 14.5 to 16.5 dB. Included is an expanded scale readout whose range of 0 to 3 dB is spread over 50% of the 6 inch meter scale. A unique zero offset feature permits any noise figure reading to be set within this portion of the meter scale.

Other features include a manual noise figure measurement capability, a removable modulator for use during operation of noise sources in a remote location, and an all solid-state design (an AIL exclusive) for greater stability and reliability. A front panel indicator light gives a positive indication of proper operation at all times. Also available as an accessory is a modular variable frequency converter which permits operation over an IF frequency range of 40 to 150 MHz. (The basic indicator input is 30 MHz.)

Specifications

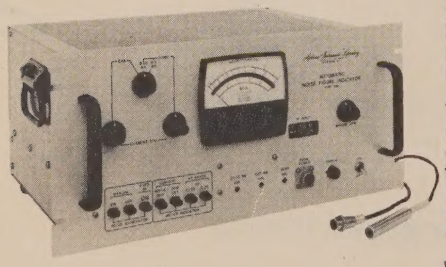
Type 75 P/N 07510

RF Range	10 MHz to 40 GHz (depends on noise source used)
Noise Figure Range	Zero to 33 dB in 5 ranges
Accuracy (automatic operation)	0 to 9 dB ±0.15 dB 9 to 12 dB ±0.25 dB 12 to 18 dB ±0.5 dB above 18 dB ±1.0 dB
Dynamic Range (AGC)	Greater than 65 dB
Operate Indicator	Front panel light
Calibration Control	Calibrates instruments to specific T_{ex} of the noise source being used
IF Gain Control	For manual operation
Meter Function	Noise figure, gas noise generator current
Input Impedance	50Ω
Power Output	Sufficient to operate gas discharge noise source in both automatic and manual modes
Frequency	30 MHz
Bandwidth	5 MHz (minimum)
Sensitivity	50 microvolts
Remote Operation	Up to 1000 feet
Recorder Output	50 mV DC, 5kΩ ungrounded output impedance
Power Requirements	115/230 V ±10%, 50 to 400 Hz, 40 watts
Overall Dimensions	20" wide x 7¾" high x 20" deep
Weight	38 pounds (rack mounted)
Price	$1,500 (rack mounted) $1,600 (cased)

Converter P/N 07530

Frequency Range	10 to 150 MHz
Bandwidth	3 MHz (minimum)
Sensitivity	100 microvolts
Price	$350

TYPE 74A AUTOMATIC NOISE FIGURE INDICATOR



The AIL Type 74A Automatic Noise Figure Indicator also provides a continuous direct meter reading of the noise figure of the device under test. It should be considered for applications where the high accuracy of the Type 75 is not required.

The device under test may be a complete receiver (radar, television, telemetering, etc.) or an amplifier. The simple operation of the AIL Type 74A Automatic Noise Figure Indicator makes it suitable for use both in the laboratory and on the production line.

With the addition of the AIL Type 32 Attenuator, the Type 74A can be used to make manual (Y-factor) measurements of noise figure.

Specifications

RF Range	10 MHz to 40 GHz for automatic operation (depends on noise source used)
Noise Figure Range (Automatic Operation)	Low scale 0 to 25 dB, high scale 23 to 36 dB
Accuracy (Automatic Operation)	Low scale ±0.5 dB, high scale ±1 dB
Dynamic Range (AGC)	Greater than 65 dB
IF Gain Control	Available for manual operation
Meter Function	Noise figure (two ranges), second-detector current, noise generator current
Power Output	Sufficient to operate all AIL noise sources in both automatic and manual modes
Recorder Output for Noise Figure	0 to 0.5 VDC nominal from 10,000Ω source impedance
AGC Output	—2 to —6 VDC
Input Power	115/230 V 50 to 60 Hz
Overall Dimensions	19" wide x 8¾" high x 14" deep
Weight	44 pounds (including one plug-in IF amplifier)

ORDERING INFORMATION

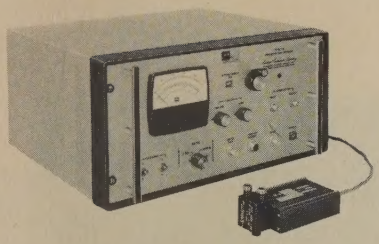
Complete Instrument (including IF strip) P/N	Price	Center IF Frequency (MHz)	IF Bandwidth (MHz)	Type	Input Sensitivity (into 50 ohms) (μV)	Standard IF Strips* P/N	Price
07413	$765	30	6	Fixed	50	07423	$275
07416	765	60	6	Fixed	100	07426	275
07412	850	10, 20 to 60	2	Tunable	100	07422	350
07414	830	30, 40 to 180	2	Tunable	100	07424	330

*Other frequencies and impedances are available on special order. Any IF strip may be plugged into the basic unit to change the IF center frequency.

TYPE 136 PRECISION TEST RECEIVER

The AIL Precision Test Receiver provides a high degree of accuracy and resolution. Manual noise measurements on low noise devices can be made to an accuracy of ± 0.1 dB with a resolution of better than 0.02 dB. Plug-in RF mixers and converters extend the useful range of the basic 30 MHz to 40 GHz.

A continuously variable attenuator with an accuracy of ± 0.05 dB/10 dB, calibratable at the NBS, provides for simple series-substitution measurements of relative RF signal level at a cost of less than one-half that of most competitive equipment.



Specifications

Postamplifier

Center Frequency	30 MHz
3 dB Bandwidth	1 MHz (nom)
Input Impedance	50 ohms (nom)
Full-scale Sensitivity	—90 dBm
Overall IF and Video Gain	100 dB
Gain Control Range	50 dB (min)

Attenuator

Range	0 to 100 dB
Accuracy	± 0.05 dB/10 dB, ± 0.3 dB (max for 100 dB change)
Resolution (½ Smallest Division)	0.01 dB

Overall Instrument

Measurement Range and Accuracy	
IF	100 dB ± 0.1 dB
RF	65 dB ± 0.1 dB
Scale Resolution (½ Smallest Division)	Normal 0.05 dB Expanded 0.005 dB
Video Output	0.5 Volt (100-ohm load)
Rise and Fall Time	1.5 usec (max)
IF Output (50-ohm Load)	100 mV (min)
Power Required	115/230 V 50 to 400 Hz, 20 watts
Price	$1,350

NOTE: The precision attenuator is available separately in the following versions:

P/N		Price
Unmounted	03230	$475
Rack Mounted	03231	$500
Case Mounted	03232	$525

ACCESSORIES

Preamplifiers

AIL manufactures two preamplifiers for use with the Type 136 Receiver. The Type 13630 is a low noise, high gain unit that is used for receiver noise measurements when the receiver under test does not have sufficient gain to provide the proper level into the Type 136 Receiver.

The Type 13650 is a lower gain unit which exhibits a very broad dynamic range. This preamplifier is used for high level measurements, and is particularly suited for attenuation measurements. Both units have clip inputs so that they may be mated to any of AIL's line of mixers.

Specifications	13630	13650
Center Frequency	30 MHz	30 MHz
Bandwidth	4 MHz	2 MHz
Noise Figure	2.5 dB	12 dB
Gain	43 dB	30 dB
Maximum Linear Output Power (0.1 dB Compr.)	—10 dBm	+15 dBm
Maximum Output Power..	—	+28 dBm
Price	$375	$425

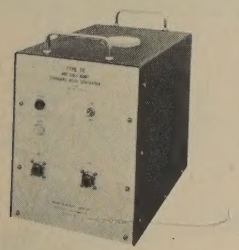
Plug-in Frequency Converter for Type 136 Preamplifiers (includes internal local oscillator)

Type Number	13635
Input Frequency Range	40 to 150 MHz
Price	$595

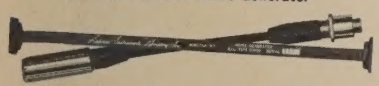
Plug-in Mixers for Type 136 Preamplifiers

AIL has a complete line of coaxial and waveguide mixers which plug directly into the 136 Preamplifiers. These units cover the range of 125 MHz through 40 GHz thus providing unparalleled versatility in the 136 Receiver system. Request price and delivery from our sales representative in your area.

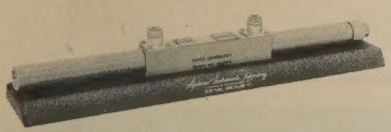
Noise Generators



Hot/Cold Standard Noise Generator



Waveguide Gas Discharge Noise Generator



Co-Axial Gas Discharge Noise Generator

Temperature — limited Diode Noise Generator

TYPE 70 HOT/COLD STANDARD NOISE GENERATORS

The type 70 Hot/Cold Standard Noise Generator provides the means for extremely accurate measurement of low noise figures over a frequency range of DC through 6 GHz. (Higher frequencies available on special order.)

The instrument employs two resistive elements; one is immersed in liquid nitrogen (77.3°K) and the other is in a temperature-controlled oven at 373.1°K. Accuracy of termination temperatures permits noise-figure measurements accurate to within 0.1 dB.

Specifications

P/N	Frequency Range	Price
07004	0 to 6 GHz	$1800

OTHER TYPE 70 NOISE GENERATORS

The AIL line includes three other basic types of noise generators: a temperature-limited diode covering from 10 to 250 MHz and; coaxial units which cover 0.2 to 5 GHz in two models; and a series of waveguide units, each model covering a full waveguide band from 2.6 to 40 GHz.

All AIL waveguide noise generators, with the exception of the Type 7096 (26.5 to 40 GHz), come equipped with internal termination which can be removed for applications requiring the use of both output ports.

Specifications

P/N	Frequency Range (GHz)	Price
Temperature-limited Diode Noise Generator		
07006	0.010 to 0.250	$125
Co-axial Gas-Discharge Noise Generators		
07010	0.2 to 2.6	$350
07012	2.0 to 5.0	$425
Waveguide Gas-Discharge Noise Generators		
07048T	2.6 to 3.95	$390
07049T	3.95 to 5.85	$350
07050T	5.85 to 8.2	$325
07051T	7.0 to 10.0	$295
07052T	8.2 to 12.4	$255
07091T	12.4 to 18.0	$395
07053T	18.0 to 26.5	$440
07096	26.5 to 40.0	$895

TYPE 71 NOISE GENERATOR POWER SUPPLY

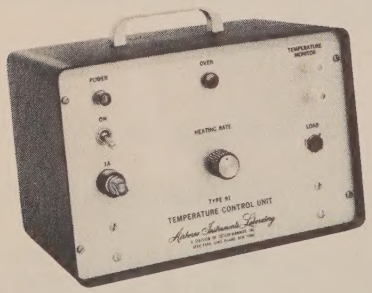
The AIL Type 71 Noise Generator Power Supply is used to operate the AIL Type 70 Coaxial and Waveguide Noise Generators for manual (Y-factor) applications. It provides sufficient starting voltage for argon-discharge noise tubes, and the output current is adjustable up to 250 mA. Six-foot cables are furnished for mating to the Type 70 Noise Generators.

Specifications

Type 71 P/N 07111

Input	115/230 V 50 to 60 Hz, 50 watts
Output	250 mA continuous
Overall Dimensions	8¾" wide x 9¼" high x 10½" deep
Weight	15 pounds

Type 90 Temperature-Controlled Terminations



The Type 90 Terminations are a line of precision waveguide assemblies incorporating a low-reflection termination in a precisely controlled thermal environment. These units are further evidence of AIL's continued leadership in the field of noise generation and measurement.

The Type 90 Temperature-Controlled Terminations are true thermal noise sources. They are useful in any application requiring precise amounts of gaussian noise. The major area of application is as a reference noise source for radiometric systems. Two such devices incorporated in a system provide a precise noise differential for calibrating the radiometer. In addition, these terminations may be used to measure noise figure, effective input noise temperature, and operating noise temperature of low-noise systems such as those incorporating parametric amplifiers or masers. They are also useful for calibrating other noise sources.

The Type 90 Terminations operate at a temperature of 100°C (373.1°K); however, they can be supplied at any temperature between 40° and 100°C.

When used with the AIL Type 91 Temperature Control Unit, the specifications are as shown:

Specifications

Temperature	100°C (40° to 100°C available when specified)
Regulation	± 0.1°C
Accuracy	± 1°C

P/N	Frequency* Range (GHz)	SWR (Max)	Price
09052	8.2 to 12.4	1.04	$ 875
09091	12.4 to 18.0	1.04	940
09053	18.0 to 26.5	1.05	1010
09096	26.5 to 40.0	1.05	1010

Type 91 Temperature Control Unit P/N 09110 $425.

*Available to 100 GHz on special order.

Specifications and prices subject to change without notice

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DEER PARK, LONG ISLAND, NEW YORK 11729

Phone: (516) 595-3216/3217

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68-40 R3

TYPE 75 Precision Automatic Noise Figure Indicator

ALL SOLID STATE — ACCURACY ±0.15 dB

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729

CONTROL AIL DIVISION

Measuring Low Noise Figure?
Here Are the Resolution and Accuracy You Need – Automatically!

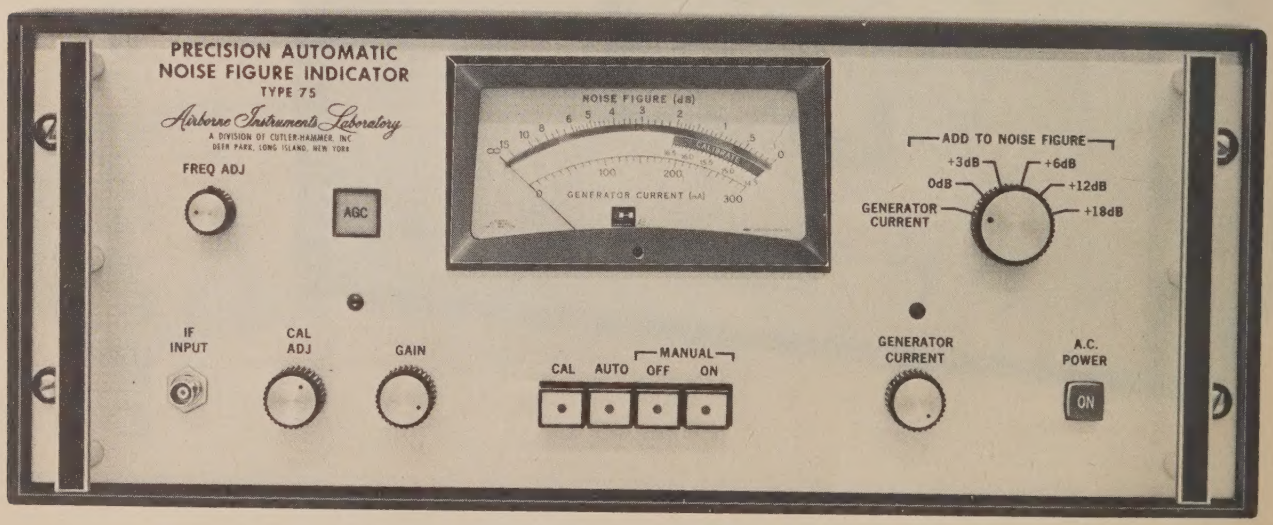
The AIL Type 75 Precision Automatic Noise Figure Indicator represents the latest state-of-the-art development in the field of noise figure instrumentation. This new instrument features all solid-state design (an industry exclusive), positive AGC indication, and a removable ignition module for remote noise source operation.

RESOLUTION AND ACCURACY

Noise figure measurements on modern RF receivers often require accurate resolution down to tenths of a dB. The AIL Type 75 Precision Automatic Noise Figure Indicator provides this capability, automatically, to an accuracy of ±0.15 dB (exclusive at noise source). An expanded meter scale provides for indications of from 0 to 3 dB, spread over 3 inches of meter arc (one-half the meter scale), enabling resolutions of a few hundredths of a dB. A unique range switching feature allows any noise figure reading to fall within this expanded portion of the scale. To further enhance system accuracy, the instrument also includes a manual capability.

SIMPLICITY OF OPERATION

The AIL Type 75 indicator has been engineered for simplicity of operation and ease-of-reading (see front panel). The blown-up views of the range switch and the meter face give some idea of the easy reading feature. Furthermore, for the first time on any automatic noise figure indicator, the instrument can be calibrated for the noise ratio of the noise generator in use, enabling direct indications of the actual noise figure of the receiver under test without having to consult correction curves.



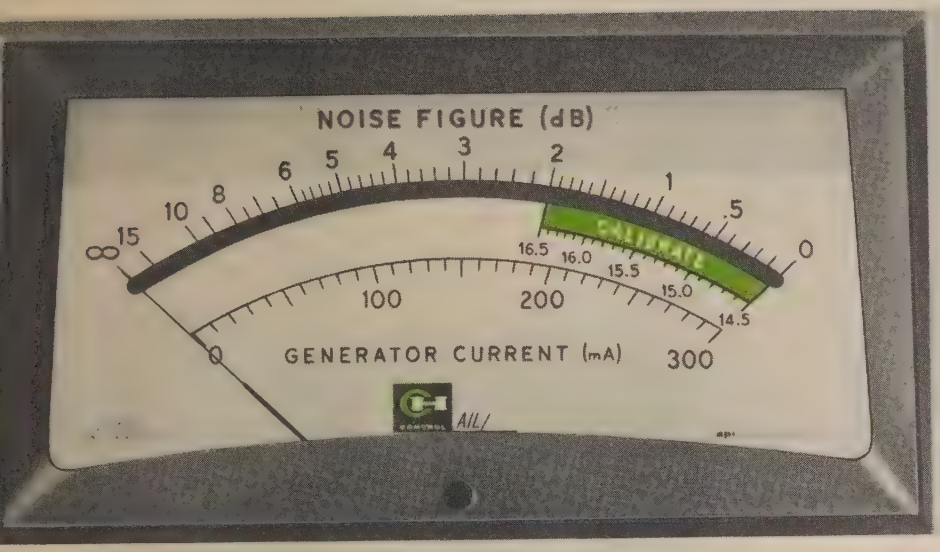
OTHER FEATURES

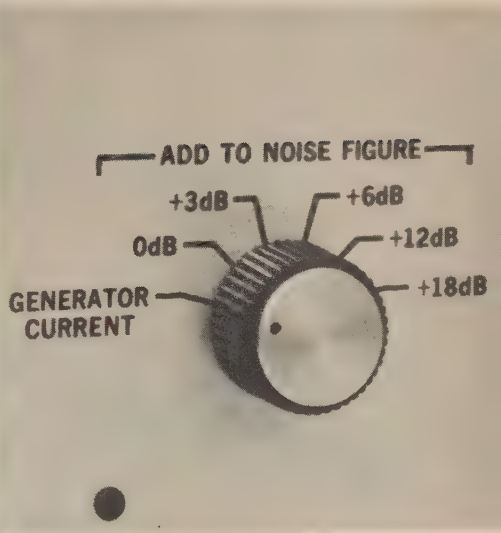
The modulator for the noise source may be easily removed for installation at remote locations. Typical of this type of installation would be a ship's radar where the noise source and modulator could be mounted on an antenna pedestal with the control unit and indicator (Type 75) located in the control room. An enclosure to house the modulator is available as an option (P/N 213000—Price $75).

The new Type 75 indicator is of all solid-state design, resulting in greater stability, longer mean-time-between-failure, and minimum maintenance. It is the only completely solid-state noise figure measuring instrument available on the commercial market today.

A prominent front panel light is used to show the operator that he has sufficient gain in the overall system to properly perform a measurement. No other noise figure indicator includes such a feature, and some can provide completely false measurements under low signal level conditions.

A useful accessory is available to further extend the application of this new instrument. A continuously variable frequency converter provides coverage from 40 to 150 MHz (the basic indicator input is 30 MHz). This unit is designed to be installed as an integral part of the overall instrument, and is available as an option.





Specifications

NOISE FIGURE INDICATOR AND CONVERTER

RF Range	10 MHz to 40 GHz (depends on noise source used)
Noise Figure Range	Zero to 33 dB in 5 ranges
Accuracy (automatic operation)	0 to 9 dB ±0.15 dB 9 to 12 dB ±0.25 dB 12 to 18 dB ±0.5 dB above 18 dB ±1.0 dB
Dynamic Range (AGC)	Greater than 65 dB
AGC Indicator	Front panel light
Calibration Control	Calibrates instruments to specific T_{ex} of the noise source being used
IF Gain Control	For manual operation
Meter Function	Noise figure, second-detector current, gas noise generator current
Input Impedance	50Ω
Power Output	Sufficient to operate gas discharge noise source in both automatic and manual modes
Frequency	30 MHz
Bandwidth	5 MHz (minimum)
Sensitivity	50 microvolts
Remote Operation	Up to 1000 feet
Recorder Output	50 mV DC, 5kΩ ungrounded output impedance
Power Requirements	115/230 V ±10%, 50 to 400 Hz, 40 watts
Overall Dimensions	20" wide x 7¾" high x 20" deep
Weight	38 pounds
Prices	
P/N 07510	$1,500 (rack mounted)
P/N 07510C	$1,600 (with cabinet)

Converter P/N 07530

Frequency Range	40 to 150 MHz
Bandwidth	3 MHz (minimum)
Sensitivity	100 microvolts
Price	$350

TRACEABILITY

The AIL Type 75 Precision Automatic Noise Figure Indicator is capable of being calibrated for the excess noise ratio of the particular noise source in use. In conjunction with this, AIL is now providing the microwave industry with the Type 82 Noise Temperature Calibration System. This calibration system provides the user with an in-house capability for constantly calibrating the noise sources in actual use. The AIL Type 75 PANFI when used with such a calibrated noise source can be used to make fast, accurate noise figure measurements which are indeed traceable to the National Bureau of Standards.

ACCESSORIES

AIL provides a full line of noise sources and accessories for use with the Type 75. Included are the following:

COAXIAL NOISE GENERATORS

Two models of the AIL Type 70 Coaxial Noise Generator cover the frequency range of 0.2 to 5.0 GHz. They employ argon-filled gas discharge tubes mounted coaxially in a helical transmission line. The output connectors to the external RF circuit are Type "N."

Specifications

P/N	Frequency Range (GHz)	Relative ENR (dB) ±0.25 dB	Tube Current (mA)	Price
07010	0.2 to 2.6	15.65	175	$350
07012	2.0 to 5.0	15.75	175	425

Part Number 07011 is identical to 07010 in specification and is fitted with Type "HN" connectors to the anode and cathode points. Price is $405.

WAVEGUIDE NOISE GENERATORS

The AIL Type 70 Waveguide Noise Generators cover the frequency range from 2.6 to 40 GHz in eight models. They employ argon-filled gas discharge tubes mounted in sections of standard waveguide at a slant angle of 10 degrees. All units excepting P/N 07096 are terminated. The terminations are easily removed for applications requiring both output ports.

Specifications

P/N	Frequency Range (GHz)	Relative ENR (dB) ±0.25 dB	Tube Current (mA)	Price
07048T	2.60 to 3.95	15.35	200	$390
07049T	3.95 to 5.85	15.6	175	350
07050T	5.85 to 8.20	15.65	175	325
07051T	7.05 to 10.00	15.75	175	295
07052T	8.20 to 12.40	15.75	175	255
07091T	12.40 to 18.00	16.15	150	395
07053T	18.00 to 26.50	16.15	150	440
07096	26.50 to 40.00	16.3	100	895

Prices and specifications subject to change without notice.

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729
Phone: (516) 595-3216 / 3217

AIL / DIVISION

Printed in U. S. A.

Type 82 Microwave Noise Temperature Calibration System

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729

Making Noise Measurements? . . .
You need AIL's Noise Temperature Calibrator for standardization and traceability.

The AIL Noise Temperature Calibration System is the first commercially available equipment designed specifically for calibration of microwave noise sources. The availability of noise standards and calibration facilities at the National Bureau of Standards (NBS) now provides industry with the means for "traceability." The purpose of the AIL system is to extend this traceability to "in-house" calibration of noise sources. This system introduces an improved concept with major advantages relating to cost and simplicity of design.

Because the system is switched at IF, changing to other RF bands requires that only the standard noise source and a minimum of front-end components be changed. This results in future cost savings to the user. Standards are presently available in both X- and Ku-bands. Other standards, compatible with this system, will be introduced as measurement facilities at NBS are expanded.

Several distinct instruments make up the overall system. These are:

Type 80 Noise Standard is a precision, argon gas-discharge noise source based on a design by the NBS. The design criteria ensure a high degree of stability and repeatability, and a low SWR over the full waveguide band.

Type 82 Control and Calibration Assembly is composed of two Type 81 Noise Source Control Units, Type 82 Microwave Noise Temperature Calibrator, preamplifier, and recorder.

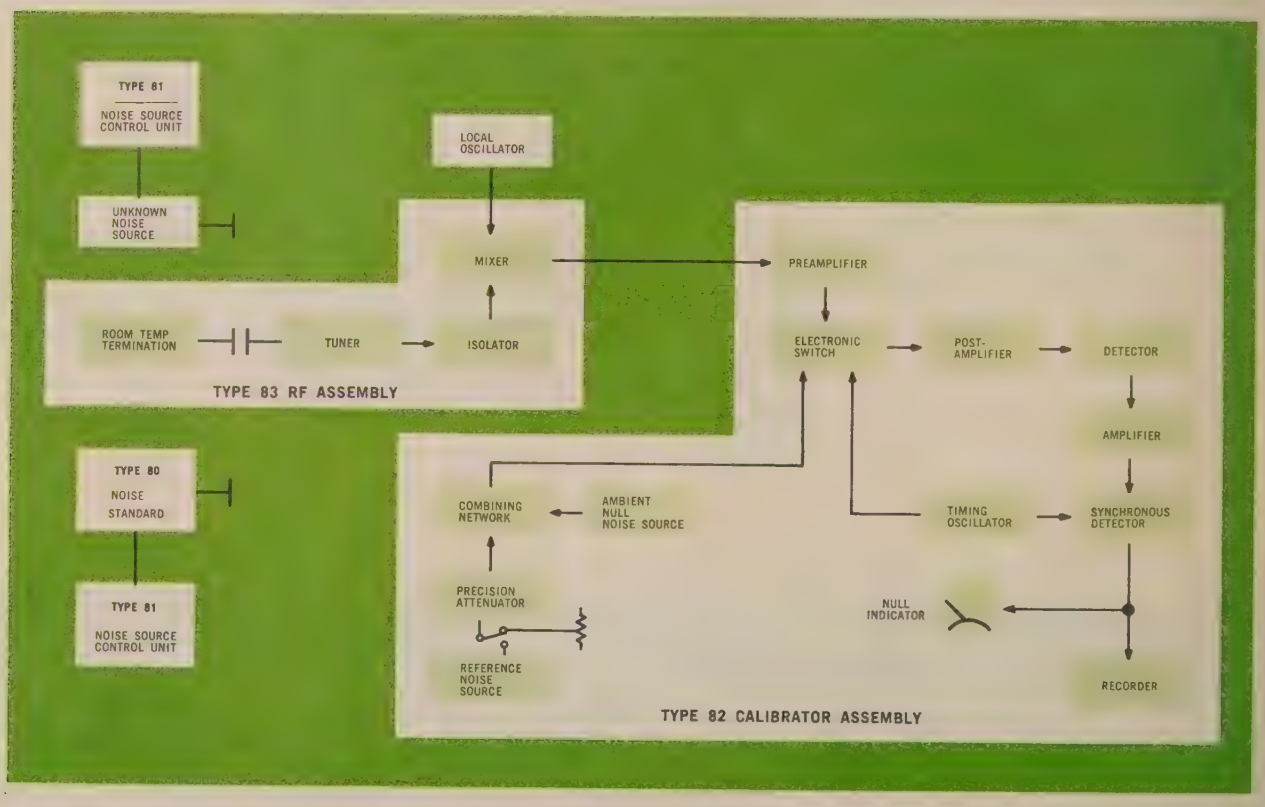
The Type 81 Noise Source Control is a highly regulated constant current, power supply that ensures repeatability and stability of gas-discharge noise sources. Two of these units are contained in the Type 82 Control and Calibration Assembly; one for the Type 80 Noise Standard the other for the generator being calibrated.

The Type 82 Microwave Noise Temperature Calibrator is capable of resolution to better than 0.01 dB/div; the Type 82 Calibrator compares the output of the Noise Standard. The difference in excess noise ratio is read directly from the front panel to an accuracy of better than ±0.1 dB.

Type 83 RF Front-End Assembly consists of a room temperature termination, slide screwtuner, isolator, mixer, and waveguide stand. It provides a simple and economical means of changing frequency ranges.

The operation of the AIL Noise Temperature Calibration System is a relatively simple matter, requiring only three steps after the initial setup. The system input is first terminated in a room temperature load, and the level of the ambient noise source is adjusted for an output null. The room temperature load is replaced by the Type 80 Noise Standard and the standard reference noise source is again adjusted for an output null. The Type 80 Noise Standard is then replaced by the unknown noise generator and the level of the reference noise source is readjusted for an output null by means of a precision attenuator. The change in the setting of this attenuator is exactly the difference (in dB) between the excess noise ratio of the Type 80 Noise Standard and the unknown.

The heart of this system is the Type 82 Noise Temperature Calibrator. Although this is a switched-load radiometer, the switching between the reference and calibration arms is accomplished at the intermediate frequency subsequent to the down conversion from the RF input.



SIMPLIFIED BLOCK DIAGRAM OF THE TYPE 82 NOISE TEMPERATURE CALIBRATION SYSTEM

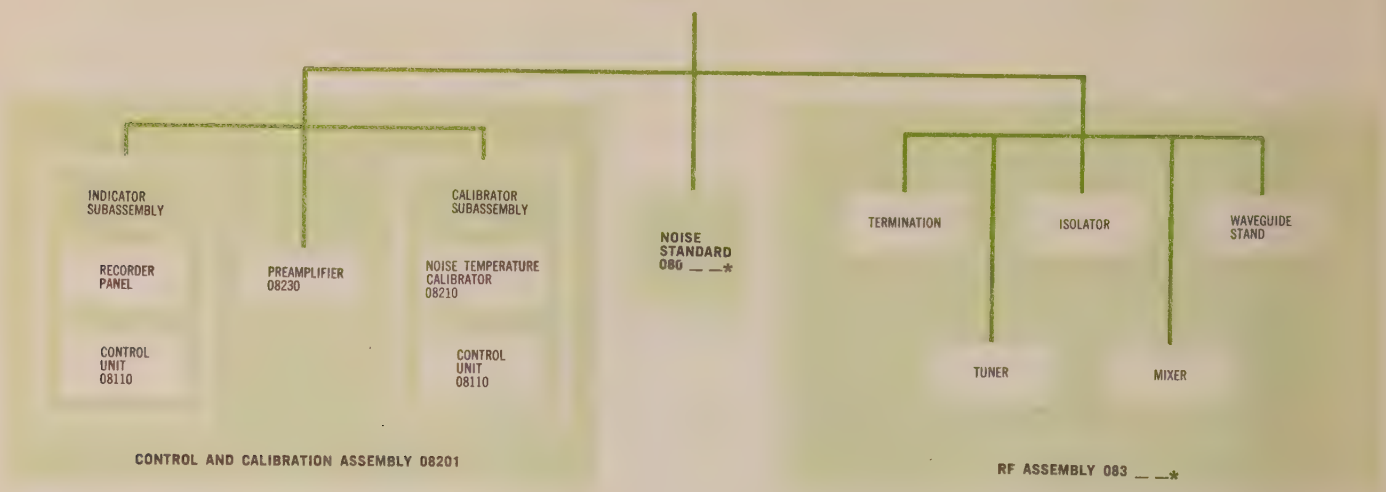
This operation provides several desirable features:

- Since there is gain ahead of the electronic switch, its noise and loss characteristics are relatively unimportant. This permits use of solid-state devices with inherent reliability advantages over mechanical switches.
- Use of solid-state switches permits a faster switching rate, thus reducing the number of large low-frequency components.
- The reference noise source operates at the intermediate frequency (30 MHz) rather than at RF, thus eliminating the need for an RF noise generator and its associated stabilized control unit.
- The calibration attenuator also operates at IF, thus it can be calibrated directly against the NBS 30-MHz attenuation standard.
- The Type 83 RF Assembly consists of a tuner, isolator, termination, and mixer. As a result, the changing of frequency ranges is simplified and accomplished at a minimum of cost.
- No computation other than adding or subtracting the attenuator change to the known excess noise ratio of the Type 80 Noise Standard is required.

Specifications

TYPE 80 NOISE STANDARD	Part Number	08052	08091
	Frequency Range (GHz)	8.2 to 12.4	12.4 to 18.0
	Waveguide Size	RG-52/U	RG-91/U
	SWR (max)	1.10:1	1.15:1
	Noise Temperature (nominal)	10,500°K	10,900°K
	Excess Noise Ratio	15.5 dB (nominal)	
	Accuracy Factory Calibration NBS Calibration	 ±500°K (±0.2 dB) ±250°K (±0.1 dB)	
	Size (inches)	12 x 6 x 4	
	Power Required	Type 81 Control Unit	
TYPE 81 NOISE SOURCE CONTROL UNIT	Range	100 to 250 mA	
	Regulation	Better than ±0.5%	
	Noise Lamp Cathode Type	Cold, filamentary, or indirect. Selectable from front panel.	
	Power Required	115/230 V, ±10%, 50-60 Hz	
TYPE 82 MICROWAVE NOISE TEMPERATURE CALIBRATOR	Center Frequency	30 MHz	
	Bandwidth	6 MHz (nominal)	
	Metering	a) Null, Normal Sensitivity 0.1 dB/div b) Null, High Sensitivity 0.01 dB/div	
	Response Time	Variable in 5 steps 0.3, 1, 3, 10, and 30 seconds (nominal)	
	Measurement Range (Excess Noise Ratio)	5 to 25 dB	
	Comparison Accuracy	±0.10 dB	
	ΔT_{ex} Readout	Calibrated to read change in relative excess noise in dB. 0.01 dB/div	
	Recorder Output	a) 2.5 k ohms b) ±25 mV full scale	
	Power Required	115/230 V, ±10%, 50-400 Hz, 50 watts	

Prices and specifications subject to change without notice.



*— — Indicates Digits Which Specify RF Range

Ordering Information

X-BAND (8.2 TO 12.4 GHz) NOISE CALIBRATION SYSTEM, P/N 08252, CONSISTS OF:

- Type 82 Control and Calibration Assembly, P/N 08201
- Type 80 Noise Standard, P/N 08052
- Type 83 RF Assembly, P/N 08352

Price: $14,600

Ku-BAND (12.4 TO 18.0 GHz) NOISE CALIBRATION SYSTEM, P/N 08291, CONSISTS OF:

- Type 82 Control and Calibration Assembly, P/N 08201
- Type 80 Noise Standard, P/N 08091
- Type 83 RF Assembly, P/N 08391

Price: $14,800

FREQUENCY CONVERSION KIT

X-Band Conversion Kit (8.2 to 12.4 GHz)	
Type 80 Noise Standard, P/N 08052	$1,100
Type 83 RF Assembly, P/N 08352	$2,430
Ku-Band Conversion Kit (12.4 to 18.0 GHz)	
Type 80 Noise Standard, P/N 08091	$1,300
Type 83 RF Assembly, P/N 08391	$2,600

CONTACT AIL CONCERNING THE AVAILABILITY OF OTHER FREQUENCY RANGES

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729
Phone: (516) 595-3216 / 3217

NEW from AIL

Type 90

Temperature-Controlled Terminations

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729
Phone: (516) 595-3216/3217

The Type 90 Terminations are a line of precision waveguide assemblies incorporating a low-reflection termination in a precisely controlled thermal environment. These units are further evidence of AIL's continued leadership in the field of noise generation and measurement.

The Type 90 Temperature-Controlled Terminations are true thermal noise sources. They are useful in any application requiring precise amounts of gaussian noise. The major area of application is as a reference noise source for radiometric systems. Two such devices incorporated in a system provide a precise noise differential for calibrating the radiometer. In addition, these terminations may be used to measure noise figure, effective input noise temperature, and operating noise temperature of low-noise systems such as those incorporating parametric amplifiers or masers. They are also useful for calibrating other noise sources.

The Type 90 Terminations operate at a temperature of 100°C (373.1°K); however, they can be supplied at any temperature between 40° and 100°C.

When used with the AIL Type 91 Temperature Control Unit, the specifications are as shown below:

Temperature — 100°C (40° to 100°C available when specified)

Regulation — ±0.1°C

Accuracy — ±1°C

Part No.	Frequency* Range (GHz)	SWR (max.)	Price
09052	8.2 to 12.4	1.04	$ 875
09091	12.4 to 18.0	1.04	$ 940
09053	18.0 to 26.5	1.05	$1010
09096	26.5 to 40.0	1.05	$1010

Note: Other Frequencies Available on Special Order.

Type 91 Temperature Control Unit P/N 09110 ..... $ 425

*Available to 100 GHz on special order.

Prices and specifications subject to change without notice.

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Type 125 Power Signal Source

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729

Now you can replace Signal Sources
and Power Amplifiers with one versatile instrument . . . . .

TYPE 125 POWER SIGNAL SOURCE SPECIFICATIONS

BAND		FREQUENCY RANGE	POWER OUTPUT*
Low	a.	0.2 to 0.5 GHz	50 watts minimum
	b.	0.5 to 0.6 GHz	35 watts minimum
Mid		0.3 to 1.0 GHz	50 watts minimum
High	a.	0.9 to 2.0 GHz	25 watts minimum
	b.	2.0 to 2.6 GHz	10 watts minimum
	c.	2.6 to 3.0 GHz	5 watts minimum

Front-panel counter settings are accurate to ±1% for all modulation and power-output settings. Frequency resettability of ±0.05% can be obtained over most of the frequency range.

* See graph for typical power-output performance.

POWER ADJUSTMENT

Low Range	50 microwatts to 50 watts
Mid Range	50 microwatts to 50 watts
High Range:	
Up to 1.8 GHz	50 microwatts to 25 watts
Up to 2.6 GHz	0.1 to 10 watts 0.1 to 10 milliwatts
Up to 3.0 GHz	0.5 to 5 watts 0.5 to 5 milliwatts

Power resettability of ±0.1 dB and power resolution of ±0.01 dB can be obtained over most of the frequency and power range. An internal directional coupler provides a low power output (SAMPLE RF), 30 ±3 dB below the main RF output, and a detected output (MOD. MONITOR), approximately 40 dB below the main RF output.

STABILITY

For constant load, less than ±1 volt change in line voltage and less than ±5°F ambient temperature variation.

Power Output (after 1 hr warmup)	±0.05 dB/hr
Frequency	
RF (after 2 hr warmup)	±40 ppm/hr and ±20 ppm/10 min
INT MOD FREQ (after ½ hr warmup)	±0.25%/hr

SPECTRAL PURITY (CW OPERATION)

Residual AM	1%
Residual FM	0.005%
Harmonics	40 dB down from fundamental
Signal-to-noise Ratio	60 dB

OUTPUT IMPEDANCE

50 ohms nominal. Maximum load SWR for above specifications is 1.5:1; typical performance is not seriously degraded for load SWR's as great as 3:1.

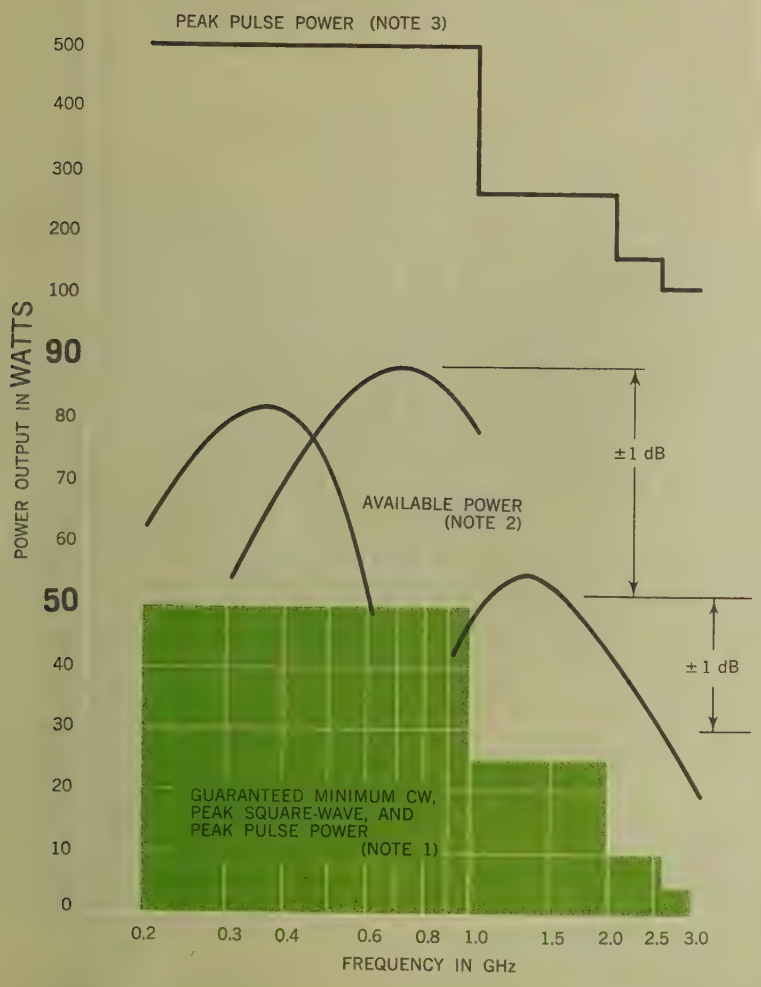
LEAKAGE

Signal-to-leakage ratio is typically greater than 80 dB for all power-output levels and frequencies.

INPUT POWER

115/230 V ±10%, 4.0/2.0 amp, 50/60 Hz.

Your answer to broadest frequency coverage for lowest dollar cost.....



NOTES:

1. At least 500 hours tube life at maximum power; much greater tube life at reduced power.
2. At reduced tube life on Low and High ranges.
3. Can be obtained using an external 3-kV power supply.

MODULATION CAPABILITY

Internal Modulation	
Square Wave (100%)	1000 Hz ±10%, adjustable
External Modulation	
Pulse (~100%)	
Width	0.5 to 25 μsec
Allowable Duty Cycle	5%
AM Square Wave (100%)	300 Hz to 10 kHz

SIZE	11⅝" x 19⅞" x 20"
PANEL DIMENSIONS	10½ x 19" (rack mounting)
NET WEIGHT	120 pounds
SHIPPING WEIGHT	185 pounds

$3,950 F.O.B.

Deer Park, Long Island, N. Y. 11729

Prices and specifications subject to change without notice.

UNLESS OTHERWISE NOTED ALL SPECIFICATIONS ARE TYPICAL

ATTENUATION (OR GAIN) AND SWR MEASUREMENTS

Examples:

- Directional Couplers
- Attenuators
- Isolators
- Circulators
- Filters
- Switches
- Delay Lines
- Limiters
- Amplifiers
- Frequency Multipliers
- Power Dividers
- RF Cables and Connectors
- Phase Shifters
- RF Detectors
- Screen Rooms

The excellent power resettability and the minimization of mismatch errors due to the tuner (variable coupling control) built into the instrument, enable insertion loss (or gain) measurements to be made as a function of power level.

Most solid-state devices (such as semiconductor and ferrite components) and most lossy devices (such as delay lines) will show significant changes in their SWR specifications at high-power levels. The high-power, 100%-square-wave-modulated, highly-stable RF output of the Type 125 can be used with all SWR meters and slotted lines currently marketed to measure SWR variation as a function of power level.

METER CALIBRATION

Examples:

- Average-Power Meters
- AC/DC Standards
- Pulse-Power Meters
- Bolometer Mount Efficiency
- Voltmeters

The outstanding power and frequency stabilities (characteristic of the AIL Type 125), coupled with the excellent spectral purity result in its being the ideal signal source for calibration service in the milliwatts-to-watts range.

OTHER APPLICATIONS

1. Antenna Testing: The typically 40-dB greater power output of the Type 125 versus milliwatt signal sources enables small, inexpensive, —60 dBm sensitivity diode detectors to replace bulky, expensive receivers on antenna test ranges. New antenna patterns, with high side-lobe suppression, can now be plotted easily and accurately.

2. Receiver Testing: The broad frequency coverage, microwatts-to-watts power output, stability, and excellent modulation characteristics of the Type 125 Power Signal Source permit the following receiver tests to be done easily and accurately:

a. Standard specifications (gain, bandwidth, time delay, phase linearity, stability versus time and temperature, modulation characteristics).

b. Overload characteristics (recovery time, RFI, intermodulation, cross modulation, AGC performance, saturation gain).

c. Rejection characteristics (image, adjacent channel, IF, selectivity).

3. General High-Power Applications: The power output of the Type 125 Power Signal Source is relatively constant (within ±1 dB over 90% of the LOW and MID ranges, and 50% of the HIGH range). This one unit can be used to replace more expensive, bulky setups using TWT amplifiers driven by low-power signal generators having typical output variations of ±3 dB. The Power Signal Source thus simplifies equipment requirements in both the laboratory and inspection departments. Some general uses not yet mentioned would be:

- RFI test signal source,
- Laser modulation,
- Transmitter driver,
- Testing multiparallel subsystems (for example, phased-array elements, image-reject mixers),
- Extending the useful frequency range of sampling oscilloscopes and RF voltmeters.

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DEER PARK, LONG ISLAND, NEW YORK 11729

Phone: (516) 595-3216/3217

Printed in U.S.A.

TYPE 136 Precision Test Receiver

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
EER PARK, LONG ISLAND, NEW YORK 11729

For the Microwave Engineer...
the Greatest Accuracy-Resolution in One Low-Cost Instrument

The AIL Precision Test Receiver is a general purpose laboratory receiver which provides a means to accurately measure changes in power level through its inherent accuracy and resolution. Plug-in RF mixers and converters extend the useful range of the basic 30 MHz receiver from 10 MHz to 40 GHz.

The Type 136 consists of a precision IF attenuator, 30-MHz amplifier, detector, and display circuit. A continuously variable waveguide below-cutoff attenuator with an accuracy of 0.05 dB/10 dB, calibratable at NBS, provides for simple series-substitution measurement of relative RF signal level at a cost of less than one-half that of most competitive equipment.

VERSATILITY

As a precision receiver for measuring IF and RF attenuation.

As an RF receiver from 10 MHz to 40 GHz through the use of exclusive plug-in RF mixers.

As an IF receiver at 30 MHz or from 40 to 150 MHz through use of a plug-in frequency converter.

As a spectrum analyzer.

FEATURES

Exceptional resolution 0.005 dB

Exceptional stability 0.005 dB

Continuously variable IF attenuator with an accuracy of ± 0.05 dB/10 dB that is calibratable at NBS.

Receiver IF output for use in AFC and phase lock applications.

Video output for use with narrow-band audio amplifiers for increased sensitivity such as SWR meters.

MEASUREMENT APPLICATIONS

Accuracy of logging characteristics of log IF amplifiers.

Impedances of low level devices using a low level signal.

Attenuation of directional couplers, isolators, pads, coaxial switches, etc.

Performance of microwave mixers — noise figure, isolation, etc.

Spurious responses of harmonic generators, solid state oscillators, signal generators, etc. Responses of comb generators.

With AIL standard noise sources, measure low noise devices to an accuracy of 0.1 dB with resolution of less than 1°K, traceable to NBS.

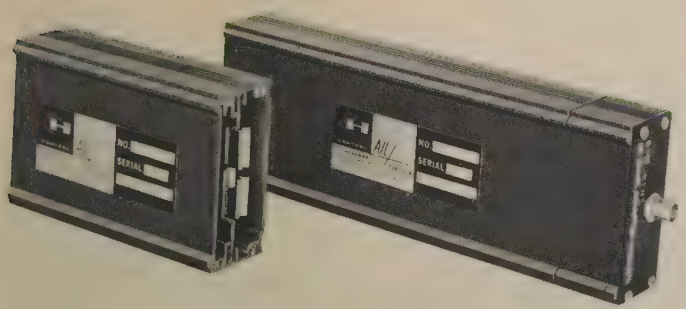
Amplitude modulation — RF and IF signals.

P/N	Frequency Range (GHz)	Price
TYPE 135 COAXIAL MIXERS		
13508	0.01 to 1.0	$495.00
13504	1.0 to 2.0	290.00
13505	2.0 to 4.0	290.00
13506	4.0 to 8.0	290.00
13507	7.0 to 11.0	495.00
13509	3.6 to 4.2	290.00
TYPE 135 WAVEGUIDE MIXERS		
13522	3.7 to 4.2	750.00
13523	4.4 to 5.0	750.00
13524	5.4 to 5.9	605.00
13525	5.9 to 6.5	605.00
13526	6.5 to 7.5	605.00
13527	7.5 to 8.5	525.00
13528	8.5 to 9.6	450.00
13529	8.8 to 10.25	525.00
13531	10.0 to 12.4	800.00
13532	12.4 to 14.0	580.00
13533	13.5 to 15.6	580.00
13534	15.0 to 17.0	580.00
13538	23.0 to 25.0	825.00
13539	34.0 to 36.0	950.00
13541	17.0 to 19.7	650.00
13542	25.0 to 29.0	1,200.00
13543	29.0 to 34.0	1,200.00
13544	36.0 to 40.0	1,250.00
13545	19.7 to 23.0	950.00
13546	8.2 to 12.4	750.00
13547	12.4 to 18.0	675.00

Specifications

TYPE 136 RECEIVER, P/N 13610

Center frequency	30 MHz
3-dB bandwidth	1 MHz nominal
Input impedance	50 ohms
Full-scale sensitivity	—90 dBm
Overall IF and video gain	100 dB
Gain control range	50 dB (min)
Attenuator	
Range	0 to 100 dB
Accuracy	±0.05 dB/10 dB
Resolution (½ smallest division)	0.01 dB
System measurement range and accuracy	
IF	100 dB ± 0.4 dB
RF	60 dB ± 0.3 dB
Metering	Mixer crystal current monitoring for single or dual crystals with polarity reversing switch. Normal second detector current. Expanded scale second detector current.
Scale resolution (½ smallest division)	Normal 0.05 dB Expanded 0.005 dB
Video output	0.5 volt (100-ohm load)
Rise and fall time	1.5 usec (max)
IF output	100 mV (50-ohm load)
Power required	115/230 VAC, 50 to 400 Hz, 20 watts
Dimensions	19-13/16 by 9-7/8 by 17-3/4 inches
Weight	30 pounds



LOW-NOISE · PREAMPLIFIER

WIDE-RANGE PREAMPLIFIER

TYPE 136 ACCESSORIES

In addition to the basic receiver described, the Type 136 Receiver can be provided with several accessory items, including:

- **Preamplifiers**
- **Mixers and Adapters**
- **Frequency Converter**

PREAMPLIFIERS

AIL makes available two preamplifiers for use with the Type 136 Receiver. The Low-Noise Preamplifier P/N 13630 is a low-noise, high gain unit useful in noise-figure and other limited dynamic range measurements. The Wide-Range Preamplifier P/N 13650 is a lower gain unit which exhibits a very broad dynamic range. This preamplifier provides a high signal level handling capability, and is particularly suited for attenuation measurements. Selection of the Type 136 Preamplifier for your application depends on the power levels to be encountered and the power handling capability of the preamplifiers.

Specifications*

LOW-NOISE PREAMPLIFIER, P/N 13630

IF noise figure	2.5 dB typical
Intermediate frequency	30 MHz
Bandwidth	4 MHz
Gain	43 dB (min)
Maximum linear output (0.1-dB compression)	—10 dBm
Output load impedance	50 ohms

WIDE-RANGE PREAMPLIFIER, P/N 13650

Maximum output power	+28 dBm (0.6 watt)
Maximum linear output (0.1-dB compression)	+15 dBm
Center Frequency	30 MHz
Bandwidth	2 MHz
Gain	30 dB
IF noise figure	12 dB
Output load impedance	50 ohms

*All specifications are nominal and include the 50-ohm adapter P/N 208393

MIXERS AND ADAPTERS

A complete line of mixers is available for a direct PLUG-IN capability to either preamplifier providing a broad RF coverage of 10 MHz to 40 GHz. The mixers are plugged into the preamplifier and no special tuning or adjustment of the preamplifiers is required. The mixer crystal current is monitored and can be read directly on the Type 136 Receiver. Adapters, featuring the same plug-in capability, are available to operate either preamplifier with your mixer. Units are available for use with source impedances of 50 ohms, or 150 ohms and 15 pF.

Specifications

PREAMPLIFIER IMPEDANCE ADAPTERS

50 ohms, 30-MHz source	P/N 208393
150 ohms, 15 pF, 30-MHz source	P/N 208550

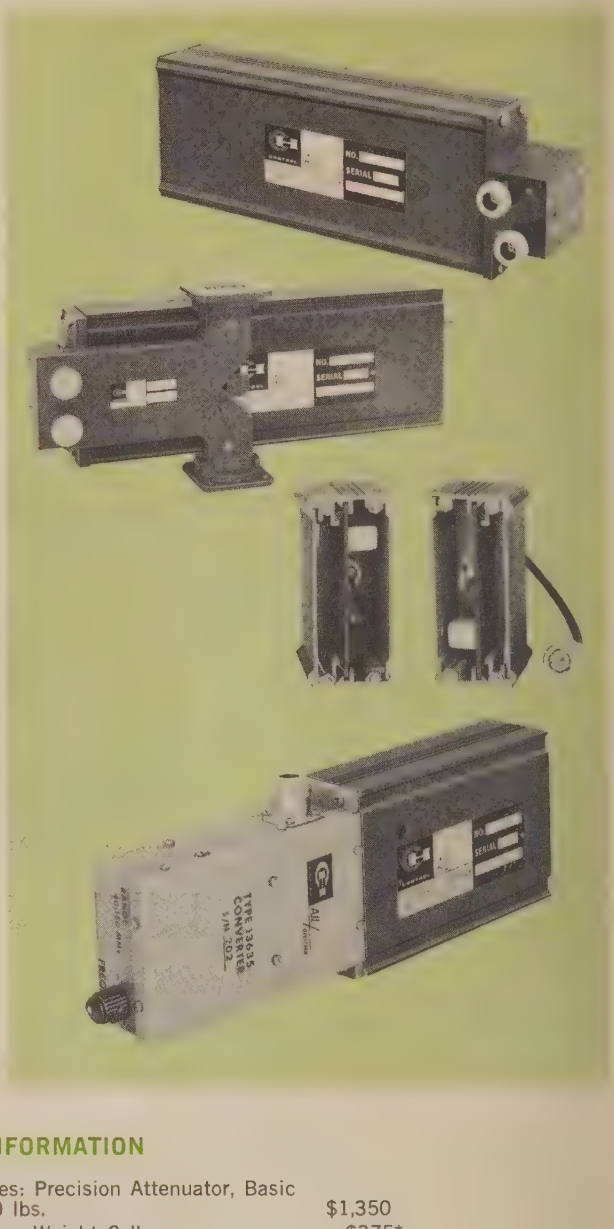
FREQUENCY CONVERTER

The converter provides a means of operating at other IF input frequencies to permit the use of the Type 136 Receiver System. The converter is tunable from 40 to 150 MHz, usable to 500 MHz. The unit plugs into either preamplifier and obtains its power through appropriate connections in the preamplifier.

Specifications

FREQUENCY CONVERTER P/N 13635

Frequency range	40 to 150 MHz
Noise figure	7.5 dB typical
Source impedance	50 ohms



ORDERING INFORMATION

Precision Test Receiver, P/N 13610 includes: Precision Attenuator, Basic Receiver, and Cabinet. Shipping Weight 40 lbs.	$1,350
Low-Noise Preamplifier, P/N 13630. Shipping Weight 2 lbs.	$375*
Wide-Range Preamplifier, P/N 13650. Shipping Weight 2 lbs.	$425*
Frequency Converter, P/N 13635. Shipping Weight 3 lbs.	$595
Preamplifier Adapter (50 ohms) P/N 208393	$50
Preamplifier Adapter (150 ohms) P/N 208550	$50

*Must be used with a Mixer, Frequency Converter, or Preamplifier Adapter

Prices and specifications subject to change without notice.

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DEER PARK, LONG ISLAND, NEW YORK 11729
Phone: (516) 595-3216 / 3217

Printed in U.S.A

Type 137 RF Attenuation Calibrator

Simple Operation — Only 4 Controls • Single-step Range — 0.01 to 100 dB • Broad-band Frequency — Coverage 10 MHz to 40 GHz

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729

Having Calibration Problems?
Here's a foolproof, simple Attenuation Calibrator that anyone can use

IF substitution systems are classified as either series or parallel depending on whether the attenuation standard is in series with the main signal path or in a parallel reference path.

The series method provides the user with such simplicity of operation as to make this approach highly desirable; however, varying system noise levels have restricted the useful measurement range of series systems compared with that usable with parallel systems.

AIL has now developed a completely new IF series-substitution system that overcomes past restrictions and greatly increases the single-step measurement range, while retaining the inherent simplicity for the user. This new improved series-substitution system, which includes several new exclusive user features, offers the following advantages:

WIDE RF RANGE
Limited only by availability of suitable mixers.

HIGH ACCURACY
From 0.007 dB for small attenuation measurements to a maximum of 0.4 dB for a 100-dB range. For increased accuracy the reference attenuator is easily removable for calibration at NBS.

EXCEPTIONAL RESOLUTION
Expanded scale operation provides sensitivity of 0.008 dB per division.

SIMPLE OPERATION
Fewer controls and adjustments greatly reduce personnel training and technical qualifications.

INTERNAL MODULATION
Requirement to modulate external signal source is eliminated, thereby reducing equipment complexity and personnel hazard.

INTERNAL AFC
Completely integrated AFC eliminates requirement to control the frequency of external signal sources.

EXCLUSIVE "PROHIBIT FUNCTION"
Prevents the operator from making false measurements if system falls out of AFC.

ALL SOLID STATE
Provides highest stability and lowest maintenance costs.

For Accurate Measurements of

- RF ATTENUATION
- IF ATTENUATION
- NOISE FIGURE
- FREQUENCY DEVIATION
- AMPLITUDE MODULATION
- SENSITIVE NULL INDICATION

Specifications

RF Range 10 MHz to 40 GHz (determined by mixer used)

Attenuation Measurement Range
Single-step measurement 100 dB (maximum)

Range versus Accuracy

Attenuation Step (dB)	Overall Accuracy (dB)
10	±0.04
20	±0.05
40	±0.07
80	±0.20
90	±0.30
100	±0.40

Attenuator
Range 0 to 100 dB
Accuracy ±0.005 dB/10-dB increment + 0.03 dB attenuator accuracy included in overall accuracy
Resolution 0.01 dB/division

Meter Functions Crystal current, Detector level, Reference level

Meter Resolutions
Normal 0.2 dB/division
Expand 0.008 dB/division

Automatic Frequency Control
Frequency error reduction 1000 to 1 (min.)
RF signal frequency drift 10 MHz
Minimum input signal —115 dBm into mixer
Maximum input signal —15 dBm into mixer

Dimensions (inches) 19-13/16 wide by 9-7/8 high by 13 deep

Power Required 115/230 VAC ±10%, 50 to 400 Hz, 40 watts

Price $3,500 F.O.B. Deer Park, New York

Exclusive Features

INTERNAL AUTOMATIC FREQUENCY CONTROL

The Type 137 consists of a dual-conversion system where AFC is maintained in the second local oscillator. This provides the user with a completely integrated system and eliminates loop gain adjustments, response time adjustments, and frequency control of external oscillators.

A front-panel indicator provides the user with a positive indication of proper AFC operation.

SOLID-STATE CONSTRUCTION

The Type 137 is the only completely transistorized instrument of its type. It provides a degree of stability, reliability, and low maintenance previously not available.

PLUG-IN MIXERS FOR BROAD RF COVERAGE

The external preamplifier is designed to accept an entire series of mixers by a simple mechanical plug-in arrangement.

AIL makes available a series of Type 135 mixers covering the frequency range from 10 MHz to 40 GHz. The user need only provide a signal source and local oscillator.

METER TIME CONSTANT

Through a unique circuit design, the detector time constant is automatically increased as the signal-to-noise ratio decreases. This ensures that the user always has the optimum time constant for his measurement and eliminates the need for a manual control.

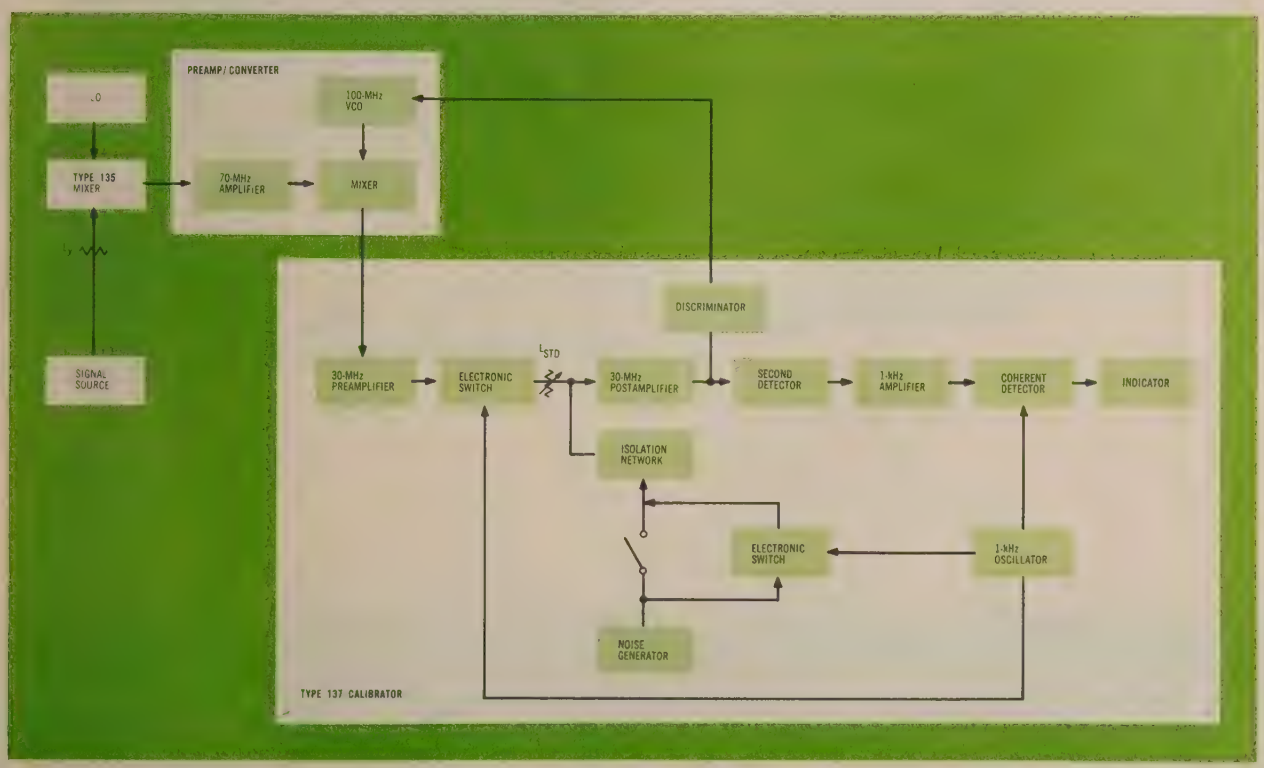
PROHIBIT FUNCTION

In addition to the front-panel AFC indicator, the Type 137 includes an exclusive function that causes the meter indication to go to zero if the unit drops out of AFC. This feature makes the instrument fail-safe since it is virtually impossible to make a measurement under improper conditions.

NOISE STABILIZATION

A unique internal noise-stabilization circuit eliminates apparent nonlinearities in the detector thereby increasing measurement range and permitting recovery of signals well below noise.

A convenient null system is provided to enable the operator to set the level of the background noise.



SIMPLIFIED SYSTEM BLOCK DIAGRAM

TABLE OF TYPE 135 MIXERS

AVAILABLE FOR DIRECT PLUG-IN OPERATION WITH THE TYPE 137

P/N	Frequency Range (GHz)	Price
TYPE 135 COAXIAL MIXERS		
13508	0.01 to 1.0	$495.00
13504	1.0 to 2.0	290.00
13505	2.0 to 4.0	290.00
13506	4.0 to 8.0	290.00
13507	7.0 to 11.0	495.00
13509	3.6 to 4.2	290.00
TYPE 135 WAVEGUIDE MIXERS		
13522	3.7 to 4.2	750.00
13523	4.4 to 5.0	750.00
13524	5.4 to 5.9	605.00
13525	5.9 to 6.5	605.00
13526	6.5 to 7.5	605.00
13527	7.5 to 8.5	525.00
13528	8.5 to 9.6	450.00
13529	8.8 to 10.25	525.00
13531	10.0 to 12.4	800.00
13532	12.4 to 14.0	580.00
13533	13.5 to 15.6	580.00
13534	15.0 to 17.0	580.00
13538	23.0 to 25.0	825.00
13539	34.0 to 36.0	950.00
13541	17.0 to 19.7	650.00
13542	25.0 to 29.0	1,200.00
13543	29.0 to 34.0	1,200.00
13544	36.0 to 40.0	1,250.00
13545	19.7 to 23.0	950.00
13546	8.2 to 12.4	750.00
13547	12.4 to 18.0	675.00

Prices and specifications subject to change without notice.

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER

DEER PARK, LONG ISLAND, NEW YORK 11729

Phone: (516) 595-3216/3217

Printed in U. S. A.

Type 210 Sweep Oscillator

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729

COMPARE THESE FEATURES

AIL's NEW Type 210 represents the LATEST IN . . .

Performance

- Two independently adjustable broadband sweeps
- Two independently adjustable markers are available on both broadband sweeps
- Marker width constant 1% of band swept, even on narrow sweep width
- Four CW frequencies
- Symmetrical calibrated ΔF sweep about four frequencies
- PIN-leveling available to 18 GHz, BWO grid-leveling available to 40 GHz
- Greater than 25 dB dynamic leveling range for PIN-leveled units
- Internal or external crystal-leveling options are available. Internally leveled units may be externally leveled
- External power meter leveling available

Versatility

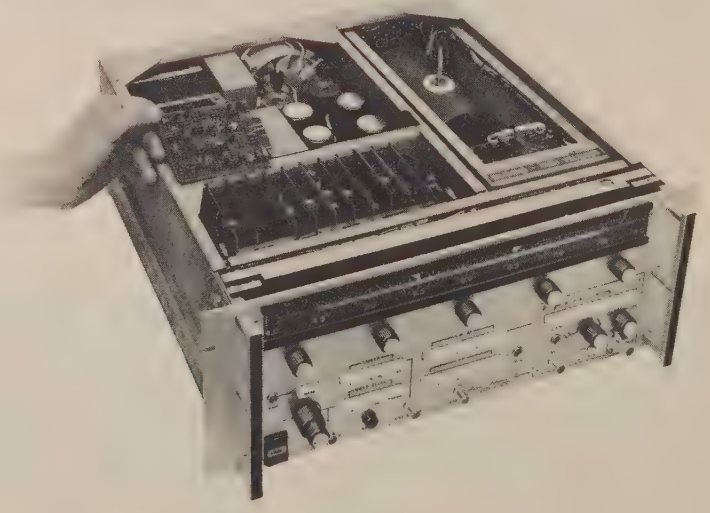
- Interchangeable RF "plug-ins" cover the frequency range from 250 MHz to 40 GHz
- Available in cabinet or rack mount
- Plug-in available with RF output from rear panel as option for rack mounting

Simplicity

- Uniquely visible, snap-in frequency and marker scales
- Human engineered front panel
- Pushbutton controls, clearly marked as to function
- Flashing leveling light indicates unleveled operation

Reliability

- Compact design makes maximum use of integrated and solid-state circuitry
- Plug-in printed circuit boards for ease of maintenance
- One year or 2500-hour warranty (whichever occurs first) for full replacement of BWO



Specifications

TYPE 210 SWEEP OSCILLATOR

Sweep Functions

Internal — F_1-F_2, sweeps from F_1 to F settings. Accuracy ±1%

M_1-M_2, sweeps from M_1 to M_2 settings. Accuracy ±1%

External — Input voltages of 0 to +20 volts can be used to externally program the unit over its full frequency range

Input Impedance	100,000 ohms
Sweep Time	8 msec (min) for full band coverage
FM Rate DC to 100 Hz	for full band coverage
to 1 kHz	for 10% of full band coverage
to 10 kHz	for 2.5% of full band coverage
to 40 kHz	for 0.25% of full band coverage

CW Operation — Any one of four CW frequencies can be selected, as set by the F_1, F_2, M_1, or M_2 controls. Accuracy ±1%

ΔF Operation — A calibrated narrow band sweep can be selected which is symmetrical about any one of four center frequencies as set by the F_1, F_2, M_1, or M_2 controls. Fifteen calibrated ΔF widths are available to an accuracy of ±10% of width selected. Maximum width is a nominal 10% of full frequency range. Center frequency accuracy is ±1%.

Sweep Modes

Fast (Recurrent) — Sweep time continuously adjustable from 1 sec to 10 msec. Retrace time is approximately 6 msec

Slow (Single) — Sweep time is continuously adjustable from 1 to 100 sec. Retrace time is approximately 0.5 sec. Sweep can be triggered from a front panel pushbutton or from an external trigger of amplitude >6 volts

Dwell Time — A time delay is introduced at the beginning of the sweep to ensure that the RF power is stabilized after the flyback interval. A time delay at the end of the sweep ensures that the start of the flyback is not visible on a display. These dwell times also serve to sharply define the limits of the sweep display

Synchronize — Synchronized to line frequency

Manual — Manual control varies RF frequency between F_1-F_2 or M_1-M_2 settings

Markers

Markers M_1 and M_2 available during F_1-F_2 sweep

Markers F_1 and F_2 available during M_1-M_2 sweep

Marker Width — Constant 1% of swept width
Marker amplitude is adjustable and markers are available during leveled and unleveled operation

Marker Accuracy ±1%

Resolution Better than 0.05%

Amplitude Modulation

Internal — Square wave variable from 900 to 1100 Hz. On/Off ratio 25 dB min

External AM

Linear — Frequency response within ±1 dB: DC to 10 kHz
Sensitivity: 200 mV for 50% modulation depth
Input Impedance: 5000 ohms

Pulse — RF Normally Off; —5 volts will turn RF power full on

On/Off Ratio	25 dB min
Rise Time	1 usec
Input Impedance	200 ohms

Sweep Output Voltages

Sweep Out
Constant amplitude sawtooth: 0 to +20 volts concurrent with swept RF output

Proportional Sweep Output
0 to —20 volts: The instantaneous value is proportional to the RF frequency being generated

Range Extender

Sweep time may be extended by an external capacitor: in the longest sweep time each additional 20 uF will increase the sweep time an additional 100 seconds

Pen Lift

Relay contact closure during sweep time, open during flyback provided for X-Y recorders during SLOW sweep

Power Requirement

115/230 V ±10%, 50-60 Hz, 150 VA

Size

19⅞" x 7⅞" x 18" (Cabinet)
19" x 7" x 17" (Rack Mount)

Weight

60 pounds: (Cabinet) } Less
40 pounds: (Rack Mount) } "Plug-Ins"

Price

$1,600.00 (With Cabinet)
$1,525.00 (Rack Mount)

TYPE 210 RF "PLUG-INS"

ΔF Width

Sweep width of the four ΔF pushbuttons is arranged in a BCD (1, 2, 4, 8) sequence, thus permitting a total of 15 ΔF steps to be selected. Accuracy is ±10% of the ΔF width selected.

Blanking

RF power may be turned off during flyback to establish a baseline.

Leveling

Internal or external leveling, PIN or BWO grid, leveling options are available (table of RF "Plug-ins"). Internally leveled units contain an integral directional coupler and crystal detector. Both internally and externally leveled units may be externally leveled through an external crystal or power meter. Input impedance of leveling amplifier is approximately 2000 ohms.

Leveled Output Power

Continuously adjustable over a range of at least 25 dB on PIN-leveled units and over approximately 10 dB on BWO grid-leveled units. A flashing light indicates unleveled operation.

Spurious Signals

Harmonics: at least 20 dB below the CW output. Nonharmonics: noise power in any 100-kHz bandwidth greater than 5 MHz from the carrier, at least 50 dB below the carrier CW output.

Frequency Stability

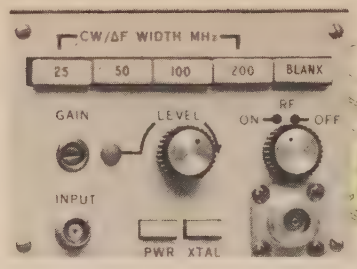
With temperature ±0.01%/°C
With 10% change in line voltage ±5 ppm
Residual FM see table of RF "Plug-ins"

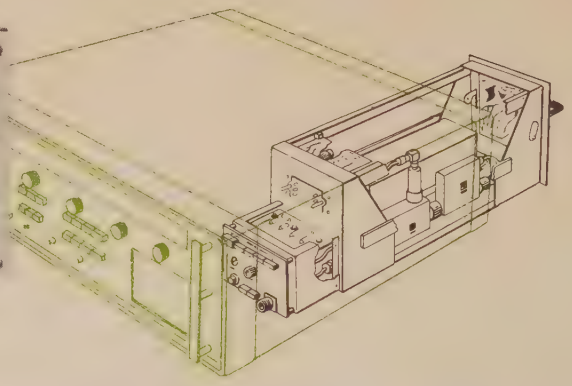
Phase Lock

Rear panel input to RF oscillator to enable external synchronizing to a frequency synchronizer or an external frequency source.

Price

See table of RF "Plug-ins."





PLUG-IN TABLE

AIL P/N	FREQUENCY GHz	POWER OUT mW	POWER CONTROL	LEVELING	LEVELED PWR VARIATION dB*	ΔF WIDTH MHz	RESIDUAL FM (MAX) kHz	RF CONNECTOR	PRICE
21075	0.25-0.50	30	PIN	Ext.	± 0.1	1.5-22.5	7	N	$2000
21030	0.5-1.0	60	PIN	Ext.	± 0.1	2.5-37.5	15	N	2000
21031	1.0-2.0	60	PIN	Ext.	± 0.1	5-75	40	N	2200
21040	1.0-2.0	50	PIN	Int.	± 0.3	5-75	40	N	2500
21053	1.0-2.0	100	Grid	Ext.	± 0.2	5-75	40	N	1850
21054	1.0-2.0	80	Grid	Int.	± 0.4	5-75	40	N	2150
21032	1.0-2.5	100	PIN	Ext.	± 0.1	10-150	30	N	2350
21033	1.7-4.2	25	PIN	Ext.	± 0.1	15-225	60	N	2250
21042	1.7-4.2	20	PIN	Int.	± 0.3	15-225	60	N	2600
21057	1.7-4.2	50	Grid	Ext.	± 0.2	15-225	60	N	1950
21058	1.7-4.2	40	Grid	Int.	± 0.4	15-225	60	N	2300
21034	2.0-4.0	55	PIN	Ext.	± 0.1	15-225	45	N	2000
21043	2.0-4.0	45	PIN	Int.	± 0.3	15-225	45	N	2300
21059	2.0-4.0	100	Grid	Ext.	± 0.2	15-225	45	N	1700
21060	2.0-4.0	80	Grid	Int.	± 0.4	15-225	45	N	2000
21071	3.5-6.75	20	PIN	Ext.	± 0.1	20-300	75	N	2250
21070	3.5-6.75	40	Grid	Ext.	± 0.2	20-300	75	N	1950
21035	3.7-8.3	20	PIN	Ext.	± 0.1	30-450	70	N	2200
21044	3.7-8.3	15	PIN	Int.	± 0.4	30-450	70	N	2550
21061	3.7-8.3	50	Grid	Ext.	± 0.2	30-450	70	N	1900
21062	3.7-8.3	40	Grid	Int.	± 0.5	30-450	70	N	2250
21036	4.0-8.0	25	PIN	Ext.	± 0.1	25-375	70	N	1950
21045	4.0-8.0	20	PIN	Int.	± 0.4	25-375	70	N	2300
21063	4.0-8.0	50	Grid	Ext.	± 0.2	25-375	70	N	1550
21064	4.0-8.0	40	Grid	Int.	± 0.5	25-375	70	N	1900
21037	7.0-12.4	16	PIN	Ext.	± 0.1	30-450	100	N	2200
21046	7.0-12.4	12	PIN	Int.	± 0.6	30-450	100	N	2600
21065	7.0-12.4	40	Grid	Ext.	± 0.2	30-450	100	N	1800
21066	7.0-12.4	32	Grid	Int.	± 0.7	30-450	100	N	2200
21038	8.0-12.4	32	PIN	Ext.	± 0.1	30-450	80	N	1950
21047	8.0-12.4	25	PIN	Int.	± 0.6	30-450	80	N	2350
21067	8.0-12.4	80	Grid	Ext.	± 0.2	30-450	80	N	1550
21068	8.0-12.4	65	Grid	Int.	± 0.7	30-450	80	N	1950
21039	12.4-18	20	PIN	Ext.	± 0.1	35-525	110	UG-419/U	2050
21069	12.4-18	50	Grid	Ext.	± 0.2	35-525	110	UG-419/U	1650
21048	10.0-15.5	20	Grid	Ext.	± 0.2	35-525	100	WR-75	2500
21049	10-20	5	Grid	Ext.	± 0.2	50-750	200	UG-419/U	2550
21050	18.0-26.5	25	Grid	Ext.	± 0.2	50-750	180	UG-595/U	2500
21051	26.5-40	10	Grid	Ext.	± 0.2	100-1500	190	UG-599/U	4200

*Includes coupler and detector variations for internally leveled units only.

Other frequency ranges available on special order.
Manufactured under license agreement with MESL.
PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729
Phone: (516) 595-3216 / 3217

Printed in U.S.A.

WRIGHT ENGINEERING
175 S. San Antonio Road
Los Altos, California 94022
(415) 941-4405

Microwave Crystal Test Set

Type 391

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK, LONG ISLAND, NEW YORK 11729

Type 391 Microwave Crystal Test Set for Biased and Unbiased Crystals

The AIL Microwave Test Set measures the important performance characteristics of microwave crystals rapidly and accurately. To a large extent, these characteristics determine performance of crystals in mixer and detector applications. A simple DC technique is used to measure quantities that are mathematically related to crystal performance.

The AIL Microwave Test Set, because of its small size, weight, and battery operation, is ideally suited for use in the field, in the laboratory, and on the production line.

- Measure relative noise figure
- Match crystal pairs
- Measure relative sensitivity

Specifications

- Measurement accuracy

Relative noise figure error	1.0 dB max, 0.3 dB mean
Relative sensitivity error	2.0 dB max, 0.6 dB mean
Pair matching	Sufficient sensitivity to assure 20-dB suppression of local oscillator noise
Conversion loss error	0.9 dB max, 0.3 dB mean
Noise temperature error	0.7 dB max, 0.3 dB mean

FEATURES

- Tests 1N21, 1N21A through 1N21E, 1N23, 1N23A through 1N23E, 1N25, WE1N26, SYL1N26, 1N28, 1N31, 1N32, 1N53/0938, 1N78, 1N78A, 1N78AR, and 1N263 crystals.
- Accepts ceramic, coaxial, and axial lead crystals, both normal and reversed polarity.
- Remote jack permits testing crystals without removing them from the receiver.
- Is self-contained, portable, and battery powered for operation in all locations.
- Is small and lightweight: 6¼ x 6½ x 3¼ in., 3 pounds net, 5½ pounds shipping weight.
- Designated Federal Stock No. 6625-373-1859

$195.00 F.O.B. Deer Park, Long Island, New York

Prices and specifications subject to change without notice.

AIRBORNE INSTRUMENTS LABORATORY A DIVISION OF CUTLER-HAMMER
DEER PARK LONG ISLAND, NEW YORK 11729
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NAME _____ TITLE _____

COMPANY _____ DEPT. _____

ADDRESS _____ TEL. _____

_____ EXT. _____

Frequency Range of Interest _____

Please send information on the following:

- ☐ Precision IF Attenuators
- ☐ Noise Figure Measuring Equipment
- ☐ Noise Temperature Calibrator
- ☐ Temperature-Controlled Terminations
- ☐ Attenuation Calibrator
- ☐ Precision Receiver
- ☐ Microwave Sweep Oscillators
- ☐ Power Signal Source
- ☐ Microwave Crystal Tester

☐ Please add my name to your MICROWAVE INSTRUMENTS Mailing List

☐ URGENT - Have your Representative call

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DEER PARK, LONG ISLAND, N. Y. 11729

MICROWAVE INSTRUMENTS — PRICE LIST

Type 32 Precision IF Attenuators

03230	$ 475
03231	500
03232	525
03260	475
03261	500
03262	525

Type 70 Noise Generators

07004	$1,800
07004SP	1,950
07006	125
07010	350
07011	405
07012	425
07048T	390
07049T	350
07050T	325
07051T	295
07052T	255
07091T	395
07053T	440
07096	895

Type 71 Noise Generator Power Supply

07111	$ 225

Type 74A Automatic Noise Figure Indicator

07413	$ 765
07416	765
07414	830
07412	850
07423	275
07426	275
07424	330
07422	350

Type 75 Precision Automatic Noise Figure Indicator

07510	$1,500
07510C	1,600
07530	350

Type 82 Microwave Noise Temperature Calibration System

08052	$1,100
08091	1,300
08110	990
08252	14,600
08291	14,800

Type 90 Temperature Controlled Terminations

9052	$ 875
9051	940
9053	1,010
9096	1,010
9110	425

Type 125 Power Signal Source

12511	$3,950

Type 135 Coaxial Mixers

13508	$ 495
13504	290
13505	290
13509	290
13506	290
13507	495

Type 135 Waveguide Mixers

13522	$ 750
13523	750
13524	605
13525	605
13526	605
13527	525
13546	750
13528	450
13529	525
13531	800
13532	580
13547	675
13533	580
13534	580
13541	650
13545	950
13538	825
13542	1,200
13543	1,200
13539	950
13544	1,250

Type 135 Preamplifiers

204731	$ 390
204732	405
204733	390
204734	405

Type 134 Postamplifiers

13441	$ 375
13442	390
13443	375
13444	390

Type 136 Precision Test Receiver

13610	$1,350
13630	375
13635	595
13650	425
208393	50
208550	50

Type 137 R-F Attenuation Calibrator

13710	$3,500

Type 210 Microwave Sweep Oscillator

21010C	$1,600
21010	1,525
21075	2,000
21030	2,000
21031	2,200
21040	2,500
21053	1,850
21054	2,150
21032	2,350
21033	2,250
21042	2,600
21057	1,950
21058	2,300
21034	2,000
21043	2,300
21059	1,700
21060	2,000
21071	2,250
21070	1,950
21035	2,200
21044	2,550
21061	1,900
21062	2,250
21036	1,950
21045	2,300
21063	1,550
21064	1,900
21037	2,200
21046	2,600
21065	1,800
21066	2,200
21038	1,950
21047	2,350
21067	1,550
21068	1,950
21039	2,050
21069	1,650
21048	2,500
21049	2,550
21050	2,500
21051	4,200

Type 391 Microwave Crystal Test Set

39110	$ 195

Prices are f.o.b. Deer Park, N.Y. — Terms Net 30 days.
Subject to change without notice.

For further Information contact these AIL service representatives

UNITED STATES

Northeast

Louis A. Garten & Associates
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Fairfield, New Jersey
269-4339 N.Y. (Area 212)
226-7800 N.J. (Area 201)

Louis A. Garten & Associates
947 Old York Road
Abington, Pennsylvania
927-1200 (Area 215)

George Gregory Associates
9 South Main Street
Cheshire, Connecticut
272-5040 (Area 203)

George Gregory Associates
7 Erie Drive
Natick, Massachusetts
655-1330 (Area 617)

RJC Associates
219 Oak Ridge Terrace
Liverpool, New York 13088
457-3220 (Area 315)

Southeast

Lee Associates, Inc.
#5R Traylor Island
P.O. Box 1506
Huntsville, Alabama 35805
539-0761 (Area 205)

Lee Associates, Inc.
200 East Marks Street
Orlando, Florida 32803
241-4445 (Area 305)

Lee Associates, Inc.
12250 Wilkins Avenue
Rockville, Maryland
949-4800 (Area 301)

Lee Associates, Inc.
825 Burke Street
P.O. Box 906
Winston-Salem, N.C. 27101
724-2406 (Area 919)

Midwest

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Chicago, Illinois 60639
286-6824 (Area 312)

Loren F. Green & Associates
6225 University Avenue, N.E.
Minneapolis, Minn. 55421
781-1611 (Area 612)

Simpson Enterprises
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Southeast Station
Wichita, Kansas
943-0502 (Area 316)

Simpson Enterprises
P.O. Box 3873
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